REMARKS

Applicants thank Examiner Patel for the analysis set forth in the August 12, 2004 Office Action.

Priority Document

Applicants thank the Examiner for noting that the priority document has not, as yet, been filed. The priority document will be filed as part of the completion requirements when allowable subject matter has been confirmed.

Claim Objections

Applicants have responded to the claim objections by adopting the suggestions of the Examiner.

Claim Rejections under 35 U.S.C. § 103

Claim 1 presently stands rejected as being anticipated by U.S. Patent No. 3,144,162 that issued to Morris.

Applicant has carefully reviewed the Morris reference and respectfully submits that the Morris reference operates on the basis of a different inventive concept. As will hereinafter be further explained, the anti-extrusion ring 19 described in the Morris reference radially expands. In contrast, that portion of the backing ring engaging the tapered peripheral sidewall of the body, as claimed in Claim 1, plastically deforms by changing shape and applying sealing pressure at the extrusion gaps. Applicants thank the Examiner for the analysis and opportunity provided to them to amend the language of Claim 1 to distinguish over the Morris reference.

The effectiveness of the anti-extrusion ring 19 in Morris is dependent upon the pressure in chamber 11 of the vessel 10 acting on the inside surface of the anti-extrusion ring 19, to produce a net outward radial force 26 as shown in FIGURE 3, sufficient to expand the anti-extrusion ring 19 and maintain contact between the outside surface 20 of the anti-extrusion

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ring 19 and tapered seat 21 of the pressure vessel 10. This configuration requires 2 o-rings, 22 and 23, arranged in an appropriate manner to ensure that pressure from chamber 11 of vessel 10 produces a net outward radial force.

In contrast, the Foote et al invention only requires physical containment of the internal surface of the backing ring 36 and is not reliant on the pressure in opening 14 to act on the internal surface of the backing ring to eliminate the gap between the backing ring 36 and tapered peripheral sidewall 26 of body 12. The o-ring seal 34, under pressure from chamber 14, acts on the face of the backing ring 36, causing the backing ring 36 to want to reduce its thickness. Physically containing the inside surface of the backing ring 36 by mounting it in a closure 16 and reducing the thickness of the backing ring 16 by the o-ring 34 from pressure in opening 14, causes the backing ring 36 to grow outward and be contained by the tapered peripheral sidewall 26 of the body 12 as indicated by arrows 44 in Fig. 7. The outward growth 44 of backing ring 36 eliminates the gap between the backing ring 36 and the tapered peripheral sidewall 26 of the body 12 and protects o-ring 34 from the extrusion gap 40 (see FIGURES 5, 6 and 7). In turn, the backing ring 36, being made of a pliable but resistant material, cannot extrude into the extrusion gap 40 formed by resulting axial movement of closure 16 with respect to body 12 from pressure in chamber 14.

In Morris, the term "deform" from the Office Action refers to the expansion of the anti-extrusion ring due to the pressure in opening 11 acting in the internal surface of the anti-extrusion ring 19. The net radial force 26 is indicated in FIGURE 3 of Morris. Morris further explains that this action may over stress the material of the ring 19. To compensate for the over stress, Morris suggests that the peripheral diameter of the ring 19 be left larger than the diameter of the tapered seat 21 at the initial position of the ring 19. This condition will result in an initial compression of the ring 19 being anticipated by Morris, and thus result in a lower radial stress in

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ring 19 under pressure. He further suggests that the material of ring 19 be selected to have a lower modulus of elasticity to lower the stress in the material when subjected to the pressure in opening 11. It is clear that the Morris invention requires reduced stresses in ring 19 to avoid plastic deformation. These plastic deformations due to over stress of the material of ring 19 may result in burrs, sharp edges or fatigue cracks due to pressure cycles that can damage the o-rings 22 and 23. It is clear that Morris requires elastic deformations to avoid failure and that the term "deform", means to expand ring 19 to maintain contact between surface 20 of ring 19 and surface 21 of the vessel 10 within the elastic limits of the materials used in the ring 19.

It should be noted that metals stressed within their elastic limits are also subject to fatigue and cracking with repeated cycles. The number of cycles before fatigue occurs is dependent upon the magnitude of the stress the material experiences with each cycle.

The Foote et al invention utilizes the pressure from opening 14 and seal 34 to plastically deform the backing ring 36 to eliminate possible gaps between backing ring 36 and surface 26, as shown in FIGURE 7. The backing ring 36 is made from a pliable memory retaining material that resists extrusion through gaps and that portion of backing ring 36 in contact with the tapered peripheral sidewall plastically deforms to assume the shape of the space available. The space available is defined by the fit in closure 16, the tapered peripheral sidewalls 26 of body 12 and the resulting shape from the o-ring 34 under pressure from opening 14.

Once plastically formed into shape from closing and first pressure, the backing ring 36, maintains its formed shape through repeated pressure cycles and vessel opening and closing procedures. The plastic deformation of the pliable material of the backing ring 36 does not produce burrs or sharp edges and because it is plastically deformed, it does not retain stress, and therefore is not subject to stress fatigue due to repeated pressure cycles.

The Morris invention requires 2 o-rings, 22 and 23, arranged in a particular manner to ensure the ring 19 deforms outwardly to eliminate the extrusion gap. Further, the ring 19 is initially assembled with an interference fit between surface 20 of the ring 19 and surface 21 of the vessel 10. The intention of the interference fit is to reduce the stress in ring 19 when the vessel 10 is pressurized in chamber 11. The invention also requires that a gap be left between the removable retainer plate 24 and the ring 19 to allow the internal pressure of the vessel to act upon the internal surface of the ring 19. This configuration poses a problem with respect to function due to the interaction between the contact surfaces 20 and 21. If these surfaces should "lock" together due to the taper fit of the surfaces 20 and 21, the ring may not move axially with the plug member 15.

The axial force 27 in FIGURE 3, due to pressure in chamber 11, may not be sufficient to overcome the "lock" effect between the tapered surfaces 20 and 21. The net force 26 shown in FIGURE 3 also increases the contact force between the tapered surfaces 20 and 21 as the pressure in chamber 11 increases, which further enhances the tendency for the surfaces 20 and 21 to "lock" together. If this should occur, and ring 19 does not move with plug 15, a gap will form between the ring 19 and the plug member 15. If a gap forms between these two parts, the o-ring 23 will extrude through the gap and the invention will fail.

In contrast, the Foote et al invention utilizes one o-ring 34 to contain the pressure in chamber 14 and deforms that portion the backing ring 36 in contact with the tapered peripheral sidewall to ensure there is no extrusion gap exposure for the o-ring 34. There is no possibility of an alternate gap forming because there are no independent parts requiring pressure activation as in Morris. The elimination of the gap between backing ring 36 and surface 26 due to applied pressure is purely a function of the pliable backing ring 36 containing the o-ring 34 containing the pressure in chamber 14. When the pressure from chamber 14 is released, the backing ring 36

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will not lock in the taper of the bore because it is a made from a pliable material that will retain its general shape, but not retain the contact pressure 44 (FIGURE 7) without the presence of pressure in chamber 14. Contrary to Morris, this configuration does not require additional means other than the o-ring 34 for opening the chamber and extracting the backing ring 36 (i.e., it does not require a retainer plate 24 as in Morris).

The Foote et al configuration is unique in its approach to contain pressure in a closure using a resilient elastomer such as an o-ring. The best summary of the Foote et al invention is contained in FIGURE 7 where pressure from chamber 14 acts on the o-ring 34 as indicated by arrows 38 and in turn acts on the backing ring 36 as indicated by arrows 42. The backing ring 36, contained on its inside surface by closure 16, results in a net change in the shape of the backing ring 36 through plastic deformation to produce the net "creep" of the material of the backing ring 36 in the outward radial direction indicated by the arrows 44. This reaction of the backing ring 36 to pressure, its mounting in closure 16, and its containment by surface 26 ensures contact between the backing ring 36 and surface 26 as desired for the protection of the o-ring 34 from extrusion gap 40. The backing ring 36 resists extrusion by the nature of the material selected for its construction and the resulting closure of the extrusion gap 40 from pressure in chamber 14 is small compared to the gap required to extrude the backing ring 36. This same gap 40 however, would easily extrude the o-ring 34 in the absence of a backing ring 36 as claimed in this invention.

Claim 1 as amended distinguishes the invention over the "radial expansion" of ring 19 of the Morris reference. In particular, Claim 1 has been amended to explicitly recite <u>that portion of the backing ring engaging the tapered peripheral sidewall of the body plastically deforming by changing shape and applying sealing pressure at the extrusion gaps.</u>

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In view of the foregoing amendments and arguments, it is respectfully submitted that the present application is now in condition for allowance. Applicants, therefore, request reconsideration of the application and the issuance of a Notice of Allowance.

Respectfully submitted,

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